REMARKS

Claims 1-13 are pending in the application. Claims 9-13 are withdrawn from further consideration. Claims 1-8 are rejected under 35 U.S.C. § 102(b) as being anticipated by US patent application publication no. 2002/0000552 (referred to as "Morimoto").

The Applicants respectfully traverse the rejection of the claims because Morimoto does not disclose all claimed features.

Claim 1

Claim 1 is directed toward a method that uses a gas cluster ion beam to shape a solid surface. In contrast to what is claimed, the apparatus in Morimoto uses an excimer laser light of XeCl or ArF, for example, (paragraphs [0046] and [0047]) to anneal a-Si film, uses beams of monomer ions such as Ar ions to planarize the film surface (paragraph [0050] to 0053]), and uses Reactive Ion Etching (RIE) with HBr gas or Cl_2 gas (paragraph [0061]) to form gate electrodes. Additional detail for Ar ion beam milling is provided in paragraphs [0068] to [0097]. Neither the excimer laser light, the Ar ion beam or the gas used for RIE is or forms a gas cluster ion beam.

The Office Action appears to equate the Ar ion beams in Morimoto with the gas cluster ion beam recited in claim 1. The Applicants respectfully submit that this is not correct. The definition of a gas cluster ion beam may be obtained from Yamada, "Cluster ion beam process technology – 20 years of R&D history," Nucl. Inst. And Meth., 2007, pp.632-638, which is being submitted with this response in an Information Disclosure Statement. As may be seen from that reference, the gas clusters in a gas cluster ion beam is "a cluster in which gaseous substances at standard temperature are bonded to each other by van der Waals forces." Each cluster generally comprises several hundreds or several thousands of homogenous atoms or molecules that are bonded to each other by interacting forces. The Ar ion beam in Morimoto is composed of single ions instead of clusters. The process of ionizing gaseous atoms or molecules at standard temperature and pressure does not generate gas clusters.

The Ar ion beam used in Morimoto is a monomer ion beam. This is apparent from what is stated in paragraphs [0069] and [0072]:

> [0069] <u>The ion source region IS comprises</u> a gas supply port 210 for supplying a gas, such as argon gas, which is ionized by a magnet 230; a cylindrical anode 231 surrounded by the magnet 230 for generating a magnetic field to cause a plasma gas; a cathode 240 composed of a filament for emitting a thermion; and <u>an extraction electrode 250 for extracting Ar ions</u> from the generated plasma. (emphasis added)

[0072] In the above-described ion milling apparatus, the interior of the ion source region IS and the etching chamber region EC is evacuated using a diffusion pump or the like. Ar gases are then supplied via the gas supply port 210 into the ion source region IS while a voltage is applied to the anode electrode 231, the magnet 230, and the cathode 240, to thereby turn the Ar gases into a plasma condition. A voltage of approximately 800 V is applied to the extraction electrode 250 for extracting Ar ions from the Ar plasma into the etching chamber region EC. Electrons are then supplied from the neutralizer 260 and applied to the thus extracted Ar ions so that the Ar ions are combined with the electrons, thereby forming Ar atoms. The Ar atoms are then caused to collide with the p-Si film 280 on the glass substrate 270 which is fixed on the stage 290. The Ar atoms collide with the projections 100 generated on the surface of the p-Si film 280, thereby eliminating the projections 100. (emphasis added)

The Ar ion beam in Morimoto is composed of monomer ions. This beam does not constitute a gas cluster ion beam.

A different type of apparatus is required for use of a gas cluster ion beam as opposed to a monomer ion beam. An apparatus that uses gas clusters has a gas supplying nozzle opening with a diameter of about 0.1 mm because of a need to agglutinate atoms or molecules by cooling gases to generate gas clusters. By using such a small nozzle, the difference in pressure at the nozzle and at the vacuum space increases (typically several atmospheres). The gases are cooled through adiabatic expansion when the gases spout from the nozzle so that the gas clusters are generated. A smoothing apparatus using gas clusters also has an orifice with a conical shape, generally called a skimmer, to transport stably the gas clusters to an ionization chamber. In contrast to this, a smoothing apparatus using monomer beams does not need as small a nozzle and does not need a skimmer. With this understanding, it may be seen that the apparatus in Morimoto conforms to what is needed to generate a monomer ion beam but lacks essential features to generate a gas cluster ion beam.

In summary, Morimoto does not disclose or suggest the use of a gas cluster ion beam. As a result, Morimoto does not disclose or suggest all features of claim 1.

Dependent Claims 2-8

Claims 2-8 depend from claim 1 and add further limitations thereto.

With regard to claim 3, the Office Action refers to Fig. 7 in Morimoto and indicates this figure illustrates a process of repeating a continuous change between an angle equal to or greater than thirty degrees and an angle less than thirty degrees. We respectfully submit this is not correct. Fig. 7 illustrates a relationship between an irradiation angle of Ar ions and an etching rate of p-Si film (see paragraph [0036] and [0088] to [0089]. The Applicants are unable to find anything in Morimoto that discloses of suggests repeating a continuous change as claimed.

With regard to claims 4-6, the Office Action indicates Morimoto discloses in the abstract, in Figs. 3B-C and in paragraphs [0050] to [0053] the angle for the first direction and the second direction mutually is between zero and thirty degrees. We respectfully disagree. The Applicants are unable to find any such teaching in the cited figures and text.

CONCLUSION

Applicants request reconsideration in view of the discussion set forth above.

Respectfully submitted,

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